Cruising the Cancer Biomedical Informatics Grid

Peter A. Covitz, Ph.D.
NCI Center for Bioinformatics

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caBIG: From Village to City

- Cars
- Fuel
- Driving School
- Services & Businesses
- Transit Routes
- Maps & Brochures
- Visitor Information

caBIG cancer Biomedical Informatics Grid

Cars, Fuel, and Services

- Cars fill up at stations and drive to useful destinations to buy products and services
- caBIG Applications will fill up on data and drive to analytical services
  - Data services will offer standardized representations of data
  - Analytic services will offer processing routines

Transit Routes

- Buses and cars cruise the street grid to get places
- caBIG Applications cruise caBIG to get data and other services
  - Service providers must support caBIG APIs and message standards
  - Applications will be caBIG API and message-aware

Driving School

- No one is born knowing how to drive!
- caBIG citizens will need training and tutorials to use caBIG APIs and applications

Maps

- You need maps to navigate a city
- You need documentation navigate caBIG
  - caBIG systems, code, applications and APIs will be fully documented
  - Getting it to work isn't good enough; others have to be able to use it

Getting Around:

Interoperability

Courtesy: Charlie Mead

Interoperability

- **in·ter·op·er·a·bil·i·ty**
  - ability of a system...to use the parts or equipment of another system

    Source: Merriam-Webster web site

- **interoperability**
  - ability of two or more systems or components to exchange information and to use the information that has been exchanged.

    Source: IEEE Standard Computer Dictionary: A Compilation of IEEE Standard Computer Glossaries, IEEE, 1990]

Syntactic interoperability

Semantic interoperability

Semantic Interoperability

Courtesy: Charlie Mead

Pillars of Interoperability

- Common models across all domains of interest
- Foundation of rigorously defined data types
- Methodology for interfacing with controlled vocabularies

Semantic Interoperability:

Common Models

What *is* a Model?

- Human-friendly picture of complexity
- Link to ‘lower-level’ models
  - Layering and segregation of complexity
  - Abstraction and separation of layers

Courtesy: Charlie Mead

Why build models?

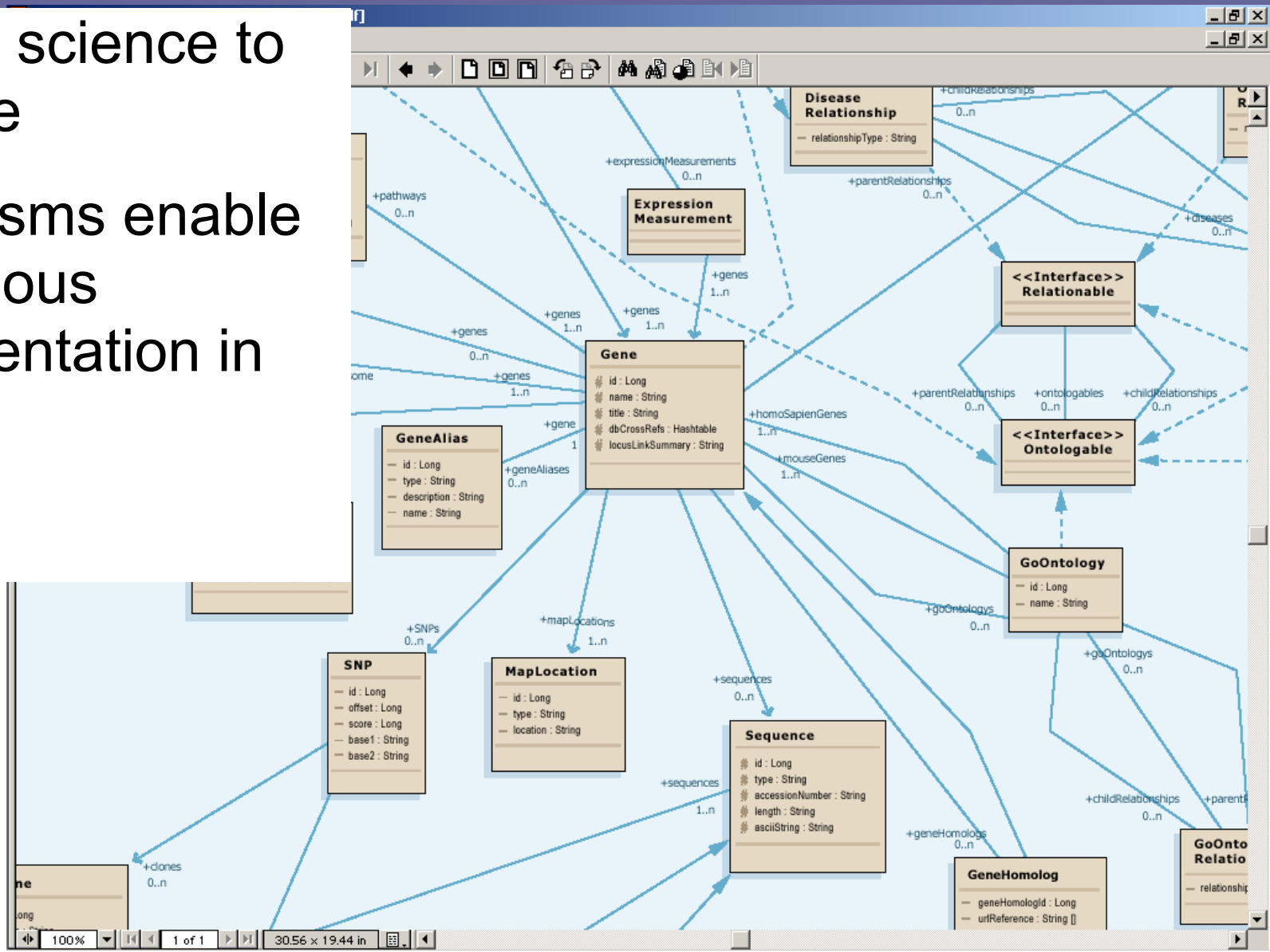
- Models represent an important vehicle for reaching *consensus* about the architecture (structure and function) of a Problem and/or a Solution

How to model in caBIG

- Industry-standard best practices
- Collect use cases
  - If the system were already built, what would you use it to do, precisely?
- Define data classes and their attributes
- Identify data class relationships
- Construct the model in UML
- Review with stakeholders, refine
- Feed into software and database designs

Unified Modeling Language

- Bridges science to software
- Formalisms enable expeditious implementation in caBIG



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Semantic Interoperability:

Common Data Elements

What is a CDE?

- Everything you need to describe and understand what a datum means
- Metadata about the individual questions and answers in a study
- A means towards semantic continuity and data comparability across studies over time

What CDEs provide to caBIG

- Solve problems of ambiguity
  - Precise definition of data types, all the way through to scientific meaning
- Save analysis time
  - Minimize need to reverse engineer meaning from data
- Enable comparability
  - Large, multi-institutional, multi-study data comparisons can provide more power

CDE development strategy for caBIG

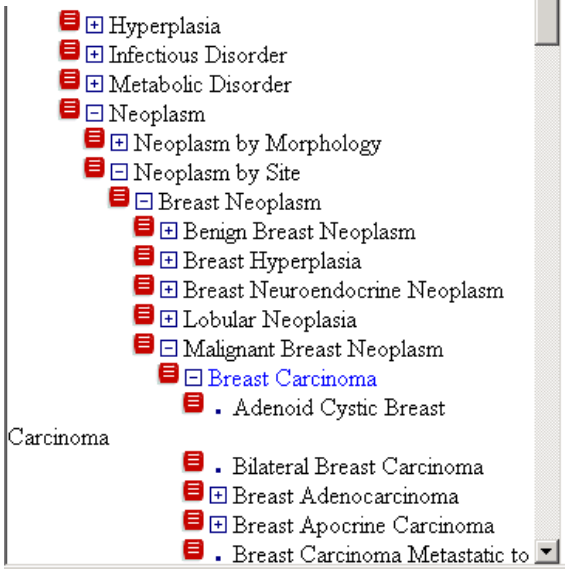
- Key Figures:
  - Investigator/study team
  - Domain experts
  - CDE Administrator
- Data elements identified as study protocols are created
  - Need-driven, not an abstract modeling exercise
- Existing CDEs re-used, new ones created as needed
  - External standards can also be represented as CDEs e.g. ICD-O-3
- Harmonization process to review CDEs and select preferred standards

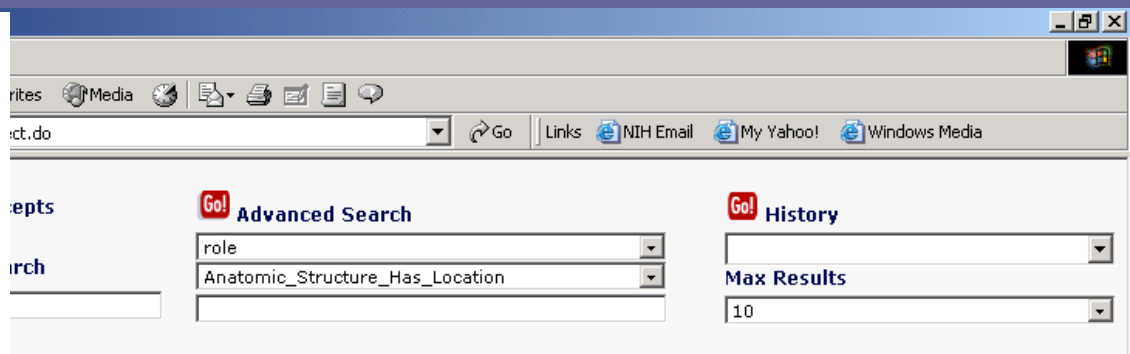
Semantic Interoperability:

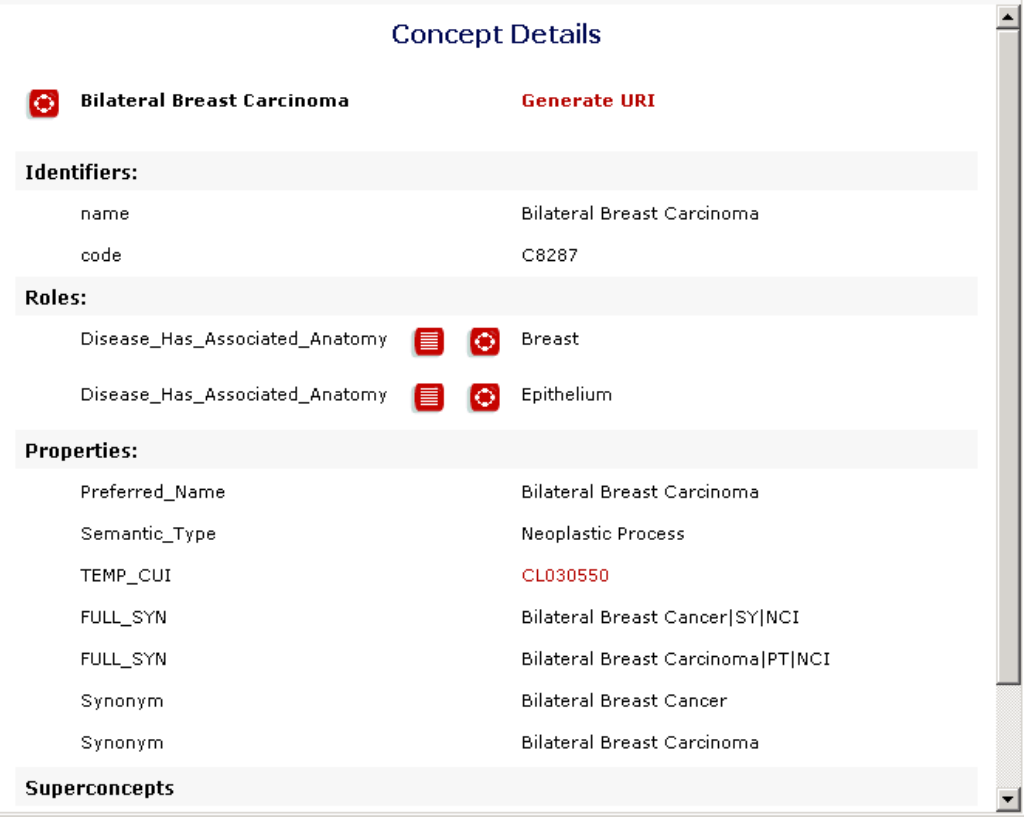
Common Vocabularies

What is a common vocabulary?

- "Concept" is central entity
- Concepts described by Preferred terms, synonyms, definitions and other properties







Why do we need Common Vocabularies in caBIG?

- CDEs and biomedical data classes are composite structures synthesized from multiple concepts
- The component concepts must be defined using common, reusable terminologies

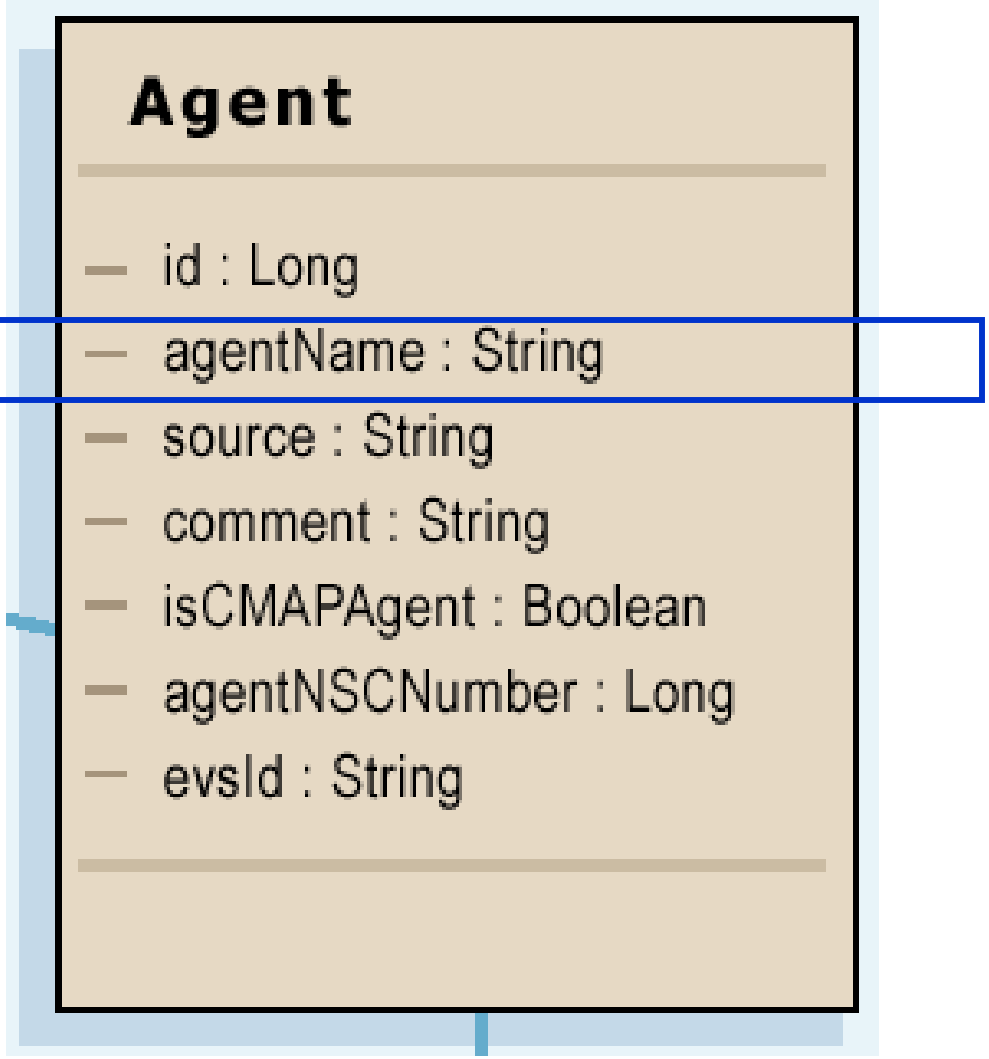
How are Vocabularies used in caBIG?

- Supply common terminology for CDE and UML data class development
- Provide data standards for valid values
- In a description logic framework, provide semantic linkages to related concepts

Semantic Interoperability:

Tying it all together

Common Model →



→ Common Data Element →

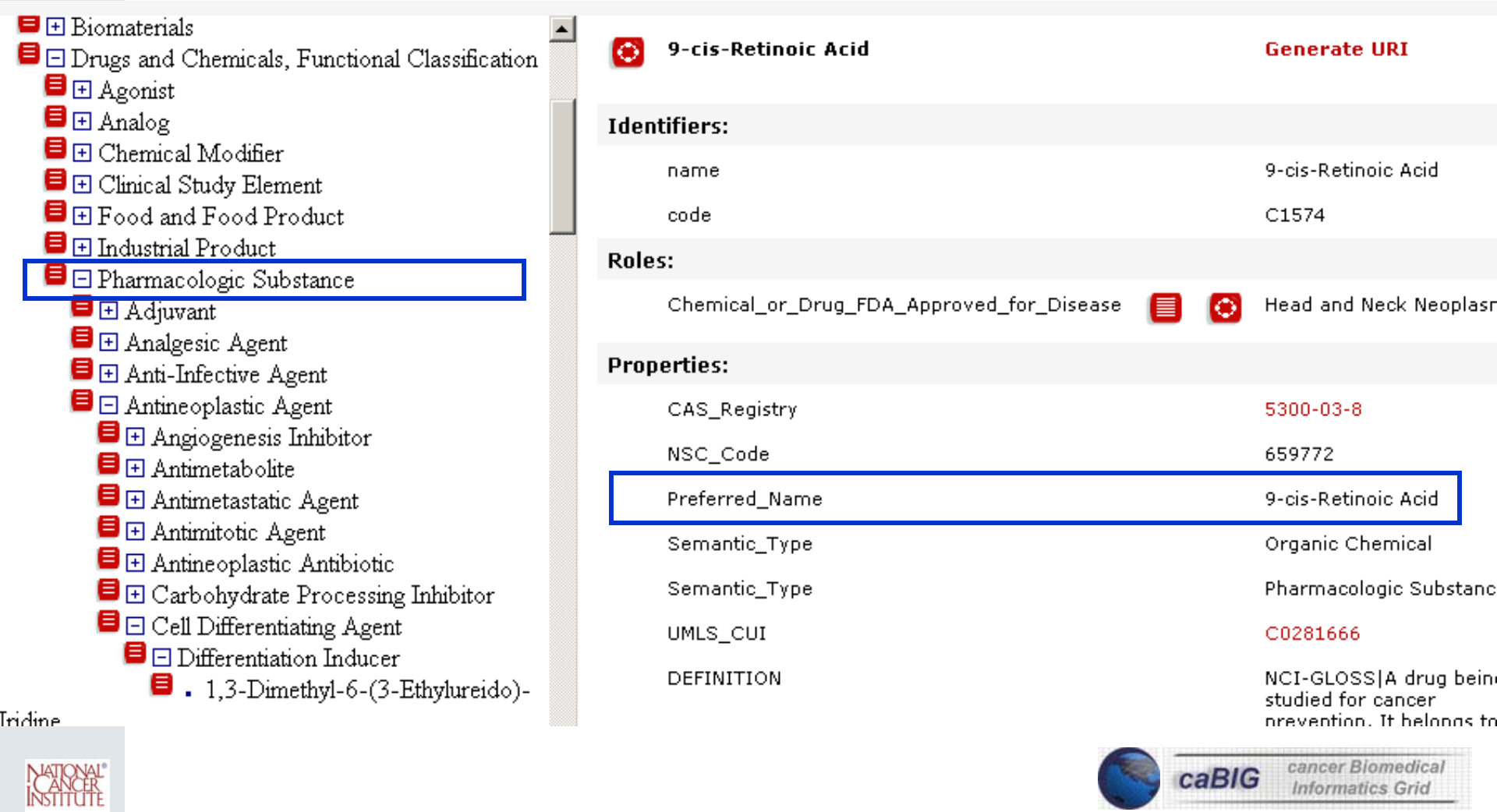
Value Domain Details

Public ID:	2018334
Preferred Name:	AGT_NAME
Long Name:	Agent Name
Definition:	the name of the agent or drug that has been administered to the patient.
Workflow Status:	RELEASED
Version:	1.0
Datatype:	CHARACTER
Unit of Measure:	
Display Format:	
Maximum Length:	100
Minimum Length:	
Decimal Place:	
High Value:	
Low Value:	
Value Domain Type:	Non Enumerated
Conceptual Domain Preferred Name:	TX
Conceptual Domain Context Name:	CTEP
Conceptual Domain Version:	1.0
Origin:	

Permissible Values

This Value Domain is Non Enumerated

→ Common Vocabulary



Syntactic Interoperability:

Common APIs

Interchange Formats

Messaging Standards

Why common APIs, formats, and messages?

- Takes less time to learn how to access more kinds of data
- Dynamic access to data stores in real time
- System-to-system messaging enables sophisticated workflows with less human intervention

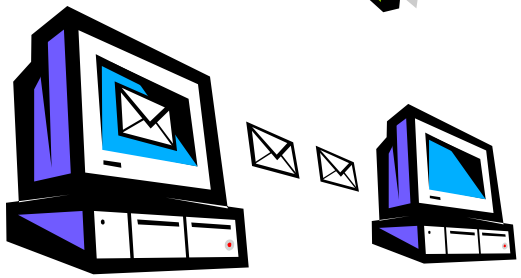
Accessible APIs for caBIG

- Aligned with common biomedical information models
  - APIs become natural extension of biomedical data domain
- Broad programming language support
  - No good if average bioinformatician can't use them!
- Extended according to a common paradigm
  - Developers only have to learn it once, then it is familiar

Interchange and message formats

- The fewer, the better
- Let's not spend all of our time writing and re-writing parsers
- Must support CDE associations in order to convey all necessary semantic content and accompanying metadata

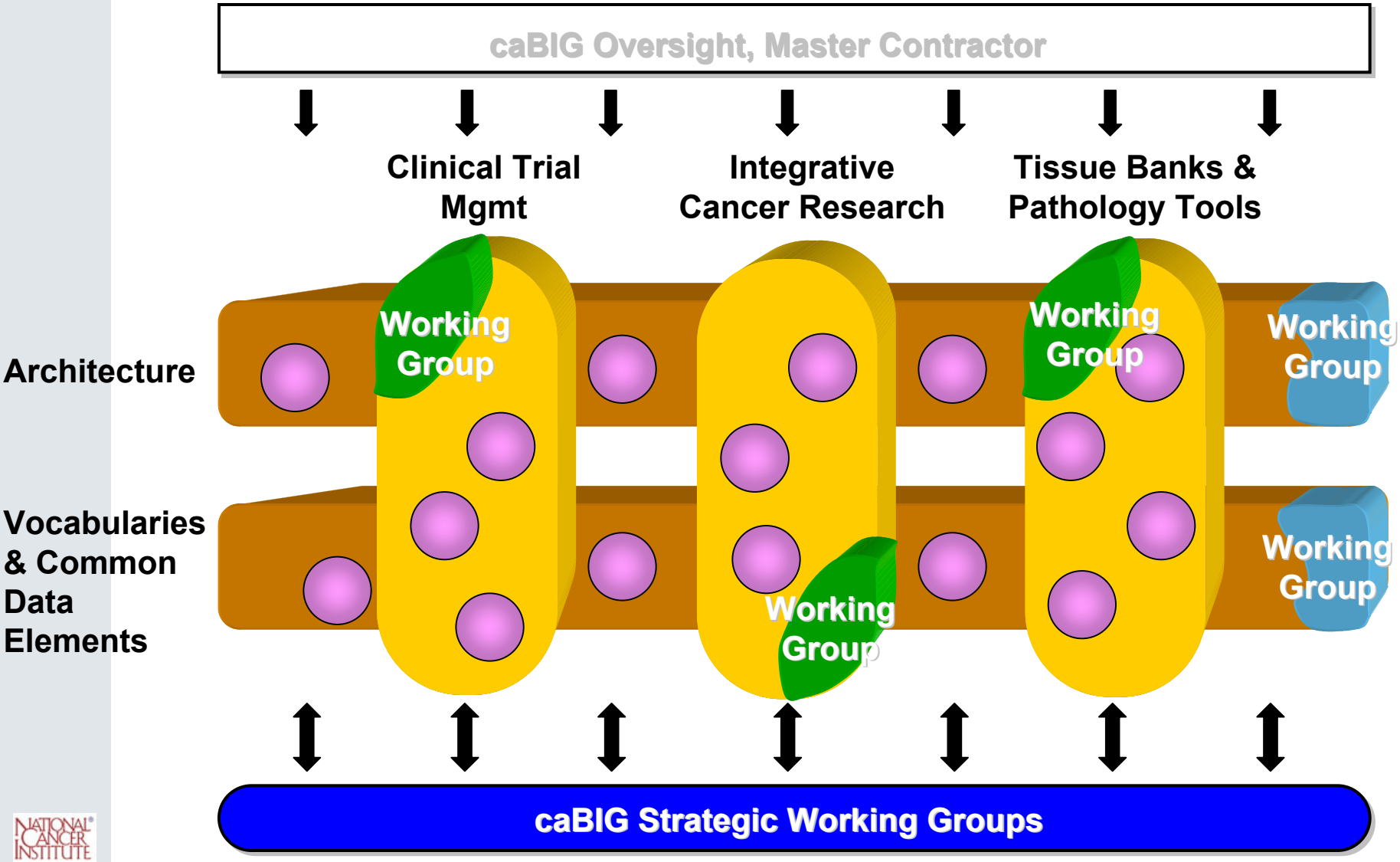
Entrance ramps:
Cross-cutting workspaces



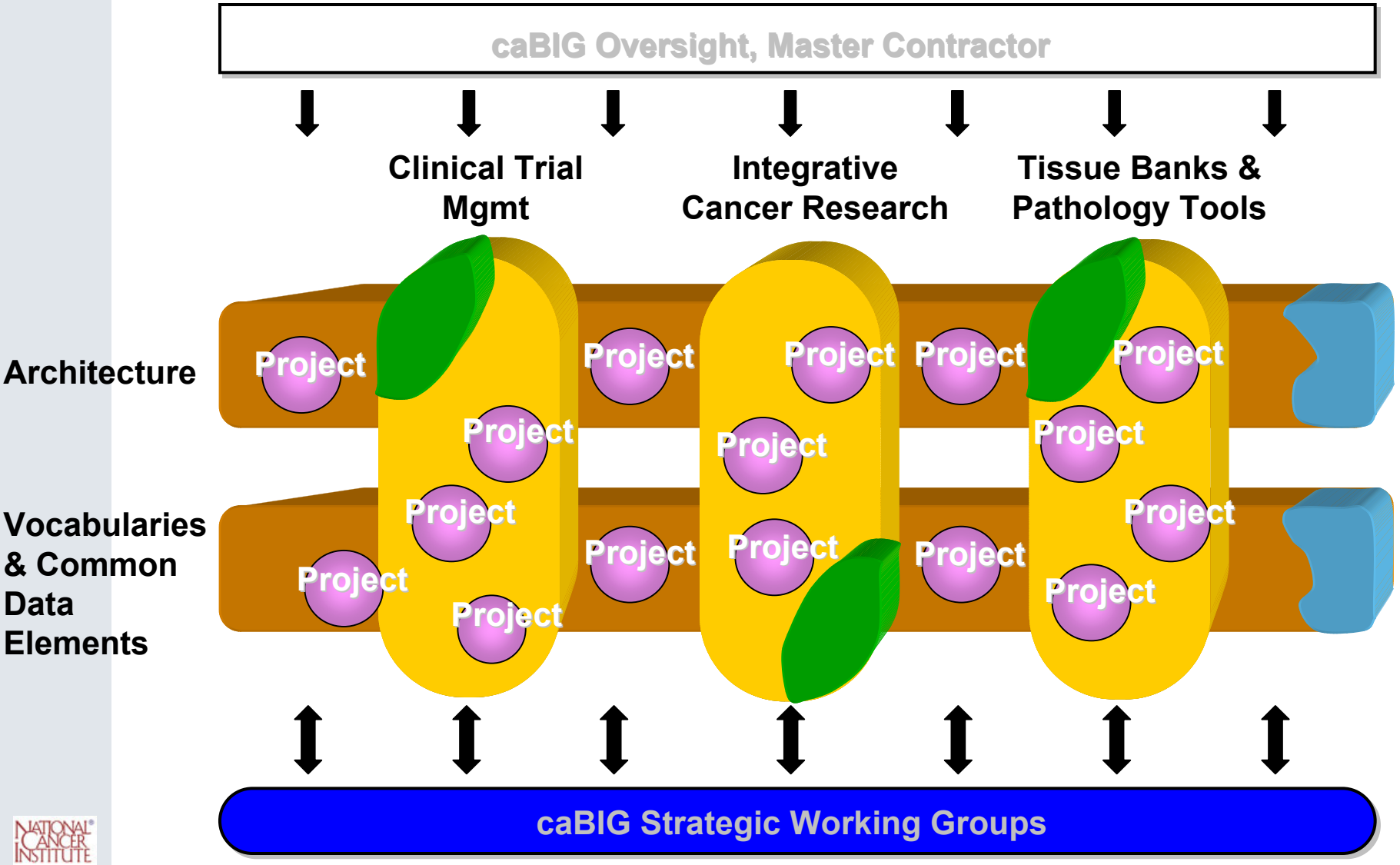
Cross-cutting Workspace Goals

- Identify, develop and publish common standards needed for semantic and syntactic interoperability
- Assist Domain workspaces with implementation of these standards
- Repeat

Urban planning



Construction, Manufacturing, Servicing, Consumption



Let's Drive!


CHELSEA
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GRAMERCY PARK
MADISON SQUARE PARK
THEODORE ROOSEVELT BIRTHPLACE
UNION SQUARE
STUYVESANT SQUARE
UKRANIAN MUSEUM
ST. MARKS CHURCH
COOPER UNION LANDMARK
TOMPKINS SQUARE
EAST VILLAGE
WEST VILLAGE
WASHINGTON SQUARE
NEW YORK UNIVERSITY
GREENWICH VILLAGE
WALKER PARK
NEW MUSEUM OF CONTEMPORARY ART
SOHO
HAMILTON FISH PARK
EAST RIVER PARK
BELLEVUE HOSPITAL
V.A. HOSP.
24TH STREET PARK
CHELSEA PARK
EAST RIVER
West Side Expwy
Franklin D. Roosevelt Dr
Broadway
Av of the Americas (6th Av)
5th Av
Madison Av
Park Av South
Lexington Av
3rd Av
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Irving Pl
Stuyvesant St
Astor Pl
Lafayette St
Bowery
Mercer St
Greene St
Bleecker St
Bond St
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